THE DEVELOPMENT AND EVALUATION OF A MEASURE ASSESSING SCHOOL NURSES' PERCEIVED BARRIERS TO ADDRESSING PEDIATRIC WEIGHT-RELATED HEALTH

BY

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Abstract

Pediatric obesity is common and is linked with numerous negative physical and mental health outcomes. Health care professionals play an important role in interventions for pediatric obesity. School nurses, who are the primary health care professionals in the school setting, represent an important but underutilized resource for addressing pediatric obesity and weight-related health. However, school nurses may perceive numerous barriers, including barriers within multiple systems, that prevent them from addressing the weight-related health of students. The current study developed and tested a new, comprehensive measure of nurses' perceptions of barriers to addressing pediatric weight-related health. The measure was evaluated using exploratory and confirmatory factor analyses and examination of nurses' perceived barriers following an intervention. The results indicated that school nurses perceive a range of barriers to addressing student's weight, including skills-based, job-related, and higher-level (e.g., societal) barriers, some of which had not been identified in the previous literature. The results also provided evidence for the validity and reliability of the measure. The findings suggest that nurses' perceptions of barriers related to addressing pediatric weight issues in the school setting are modifiable on several ecological levels. In addition, future efforts to prevent or treat pediatric weight problems, which incorporate school nurses, should assess for and consider addressing these barriers.

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Change in School Nurses' Perceived Barriers to Addressing Pediatric Weight-Related Health Following an Online Intervention

The alarming number of obese and overweight children in the United States has been well-documented. A recent epidemiological study indicated that 16.9% of U.S. children ages 2 to 19 are at or above the 95th percentile for age and sex for body mass index (BMI), and 31.7% of children are at or above the 85th percentile (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). Overweight and obesity have been linked to a variety of short- and long-term physical health, social, and mental health outcomes. Physical consequences may include the development of type 2 diabetes, and cardiovascular, orthopedic, and pulmonary problems, which take a significant financial toll on the health care system (see Vivier & Tompkins, 2008, for a review; Wang & Dietz, 2002). Overweight and obesity may also place children at risk for negative social and mental health outcomes, such as difficulties with peers (e.g., being victimized), lower health-related quality of life, and higher rates of depressive symptoms (see Zeller & Modi, 2008, for a review). Due to the negative consequences associated with overweight and obesity, numerous interventions to prevent and treat pediatric obesity have been tested (see Doak, Visscher, Renders, & Seidell, 2006; Jelalian & Steele, 2008, for reviews). Most interventions have focused on changing the physical activity and eating patterns of obese children and their families.

Theoretical Frameworks for Interventions

The design and implementation of health-related interventions (including those intended to decrease weight) is often guided by theoretical models such as the Health Belief Model (HBM; Becker, 1974) and the Health Promotion Model (HPM; Pender, 1982). These models describe factors that predict health behaviors or health behavior changes. According to the HBM, factors that predict changes in health behavior include perceptions of one's susceptibility to

health problems, the severity of potential health problems, and the perceived benefits of and barriers to making health behavior changes (Becker, 1974). Similarly, the HPM posits that perceived barriers and benefits predict health behavior changes, in addition to social forces (e.g., peer support) and situational factors (e.g., job demands; Pender, Murdaugh, & Parsons, 2005). Notably, both the HBM and HPM include *perceived barriers* as a predictor of whether individuals will engage in a health behavior. Prior empirical tests of the hypothesized relationship between barriers and health behavior indicate that perceived barriers are one of the strongest predictors of health behavior. Findings suggest that higher perceived barriers are associated with lower likelihood of engaging in health behaviors (see Janz & Becker, 1984; Pender et al., 2005, for reviews). For example, children who received solid organ transplant and who reported higher medication adherence barriers were less adherent to immunosuppressant regimens and had a significantly higher rate of organ rejection (Simons, McCormick, Mee, & Blount, 2008).

The relationship between perceived barriers and health behavior has led to the development of a range of interventions. That is, many interventions focus on lowering barriers that may prevent individuals from engaging in health behaviors. For example, a weight intervention may lower families' barriers to adopting healthier eating habits by teaching families how to implement stimulus control or how to plan for eating at special events (e.g., preparing healthy dishes, using portion control; Epstein et al., 2001). Other widely-used health interventions include those that aim to lower barriers associated with adherence to treatment regimens for chronic illness. Wysocki and colleagues (2000) tested a family-based intervention for adolescents with diabetes that focused on decreasing family-adolescent conflict thought to act as a barrier to adherence to dietary and medical regimens. Similarly, increasing child and family

knowledge about asthma treatment (e.g., knowing what medications to use and when) may lead to better health outcomes (Rachelefsky, 2007).

Interventions for Health Care Professionals

More recently, health interventions have moved beyond addressing patients' or clients' barriers and have focused on health care professionals' barriers to discussing sensitive issues such as weight. In other words, interventions have begun to target systems (e.g., the health care system) outside of the microsystem of individual children and their families. The rationale for interventions targeting health professionals is that prevention and treatment of health problems, such as those associated with obesity, will be more effective if professionals actively address patients' health problems in their clinical practice. In addition, changes in a health care professional's behavior following an intervention could potentially benefit a large number of patients.

Lowering health care professionals' barriers to discussing weight issues is particularly important given recent calls for health care professionals to address and treat obesity (American Academy of Pediatrics, 2003; U.S. Department of Health and Human Services, 2001). The literature suggests, however, that oftentimes health care professionals do not discuss weight-related topics, such as nutrition principles, with families (Perrin et al., 2008). For example, recent estimates indicate that only half of pediatricians regularly discuss weight topics with patients and their families (Rattay, Fulton, & Galuska, 2004), perhaps due to discomfort with discussing weight issues, feeling unprepared to discuss weight with patients, or a lack of adequate referral options (Perrin, Flower, Garrett, & Ammerman, 2005).

The presence of physicians' barriers to addressing weight-related health is consistent with the tenets of the Diffusion of Innovations theory (Rogers, 2003). This theory posits that when

individuals (e.g., health care professionals) are asked to adopt new ideas and implement new practices (e.g., the practice of addressing weight issues during medical appointments), they do this within the context of unique social systems that may raise challenges or barriers to adopting the new ideas. In the case of physicians and other health care professionals, barriers unique to their social systems may include a lack of training in communicating about weight issues or beliefs that health care professionals cannot effectively intervene on weight issues within their time constraints.

In response to such challenges or barriers, interventions for health care professionals such as pediatricians and medical residents have focused on lowering barriers to discussing weight-related issues with children and their families (Gonzalez & Gilmer, 2006; Schwartz et al., 2007). Consistent with the Diffusion of Innovations literature, these interventions have focused on providing physicians with knowledge or skills that enable them to better address pediatric obesity (Rogers, 2003). For example, in a feasibility study, Schwartz et al. (2007) provided pediatricians and dietitians with training in motivational interviewing (MI) techniques to facilitate their communication about weight-related health with children and their families. Although the implementation of MI techniques did not yield significant weight loss in children when compared to treatment as usual, the overwhelming majority of childrens' parents were highly satisfied with treatment sessions when MI was used. In another study, Gonzalez and Gilmer (2006) provided medical residents with information on childhood obesity and training with a nutritionist on conducting dietary interviews. Following the intervention, residents reported more knowledge about and a greater degree of comfort working with children and families on weight issues. Together, these initial studies indicate that it may be possible to lower health care professionals' perceived barriers to discussing weight-related health, particularly by

providing them with knowledge and skills that improve their ability to address pediatric obesity. However, it remains to be seen whether such interventions consistently lead physicians to implement the skills they learned (Rogers, 2003).

While enabling physicians to discuss weight issues with children and families is an important first step in improving care for overweight children, training other health care professionals to address weight-related health with children and families is of utmost importance. Consistent with a socioecological systems approach to pediatric health (Kazak, Rourke, & Crump, 2003), efforts to prevent and treat pediatric overweight should be made at multiple levels and within multiple systems involving the child. That is, interventions can be implemented directly with children and their families, as well as within other influential systems, such as with schools. Ultimately, addressing pediatric weight-related health within multiple systems may be more effective and may result in weight-related health care reaching a larger number of children (Jelalian, Steele, & Jensen, 2008).

School-based Interventions

Providing weight-related health services within the school setting may be particularly effective for several reasons. First, almost all children attend school, and thus have ready access to school-based interventions. Second, children and their families often have established relationships with school personnel, which may increase their willingness to participate in interventions and follow through with recommendations. Third, schools provide a continuity of care because children usually attend the same school for at least several years. Fourth, schools contain an established system of health care, primarily provided by school nurses, that is available to all students. It is perhaps not surprising then that parents and school nurses support the idea that schools should play a role in addressing student's weight-related health. For

instance, the majority of parents surveyed in one study were supportive of the school's efforts to address children's weight (e.g., decreasing student's access to unhealthy foods, and recommending weight loss programs to children and families who request referrals; Murphy & Polivka, 2007). School nurses, too, appear to support school-based efforts to address pediatric weight. Price, Desmond, Ruppert, and Stelzer (1987) reported that two-thirds of the nurses they surveyed believed that schools should play a larger role in addressing pediatric obesity. A more recently-surveyed sample of school nurses corroborates this finding with more than three-quarters of the nurses endorsing the notion that schools should do more than they currently are to address pediatric obesity (Nauta, Byrne, & Wesley, 2009).

Role of School Nurses

Within the school environment, school nurses are an ideal advocate for efforts to address student's weight-related health (Denehy, 2002). School nurses have received training in health topics relevant to pediatric weight-related health (e.g., nutrition principles), and are already familiar with students, including those who may have health problems related to weight. In fact, parents have noted that they prefer to receive information on their children's weight from school nurses (Murphy & Polivka, 2007). Lending support to the role of school nurses in addressing pediatric weight, the National Association of School Nurses (NASN; 2002) issued a statement that school nurses "can provide essential leadership in helping students maintain a healthy weight to decrease the burden of illness and increase quality of life and life expectancy. The school nurse can help students deal with the problem of being overweight in a proactive manner and also help to eliminate the impact of poor nutrition on learning outcomes" (Overweight children and adolescents, para. 9). Specifically, the NASN recommended that school nurses educate students and their families on nutrition and physical activity principles, identify

overweight students, provide referrals to weight management programs, and implement school-based weight management services.

School Nurses' Perceived Barriers

Despite the importance of school nurses' involvement in weight-related health care, nurses report that it is difficult to address student's weight-related health and that they often do not address weight issues (Kubik, Story, & Davey, 2007; Moyers, Bugle, & Jackson, 2005; Nauta et al., 2009; Price, Desmond, Ruppert, & Stelzer, 1987). For example, 70 to 87% of school nurses in two studies reported that counseling students and their parents about weight loss is difficult (Moyers et al., 2005; Price et al., 1987). In addition, Moyers et al. (2005) and Nauta et al. (2009) reported that 34 to 44% of school nurses usually do not recommend weight loss treatments, even to obese children. Other barriers that school nurses have reported include not feeling competent or prepared to address children's weight-related health, not having time to address weight-related health, and it not being nurses' responsibility to address students' weight (Kubik et al., 2007; Moyers et al., 2005; Nauta et al., 2009; Price et al., 1987). In summary, the existing literature on school nurses suggests that nurses may not address student's weight-related health due to a variety of perceived barriers and, particularly, perceptions that they do not have the relevant knowledge or skills (e.g., Moyers et al., 2005). These notions are consistent with the HBM, HPM, Diffusion of Innovations theory, and the previously-reviewed research with physicians.

However, there are several notable limitations to the literature on nurses' perceived barriers, particularly as related to assessment of barriers. First, existing measures of nurses' perceived barriers may not have assessed the full range of nurses' experiences and attitudes towards addressing pediatric weight-related health in the school setting. That is, barrier content

areas assessed by prior measures were not generated directly from school nurses' reported experiences with pediatric weight issues. Rather, past measures were developed from investigators' expertise, the existing literature, and relevant position statements (Kubik et al., 2007; Moyers et al., 2005; Nauta et al., 2009; Price et al., 1987). For example, the earliest and thus far, most often-used, measure (Price et al., 1987) was designed to assess nurses' perceptions of providing or discussing weight-related health programs with students and families, in addition to nurses' perceptions of other issues related to weight (e.g., whether childhood obesity is amenable to intervention, etiology of childhood obesity). This measure was formulated based on existing literature and the authors' prior work in the area (Price et al., 1987). Later investigators (e.g., Moyers et al., 2005) revised the measure to be more relevant to current-day practice by including questions on measuring BMI. Another measure designed to assess school nurses' beliefs and attitudes towards preventing obesity in the school setting (Kubik et al., 2007) was based on position statements from organizations such as the National Association of School Nurses, existing literature, the authors' expertise, and was reviewed by relevant experts. However, without directly asking school nurses about their experiences addressing pediatric weight issues, the degree to which these measures assess the full range of nurses' experiences is unknown. For instance, previous measures do not assess whether nurses experience other barriers to addressing students' weight, such as cultural factors and family behaviors affecting children's weight.

In order to identify the full range of barriers that nurses perceive, a participatory research-based model could be used, whereby school nurses are asked open-ended questions about barriers they face. Participatory research entails investigators looking to the populations they are studying (e.g., school nurses) to provide insight into issues of interest. In this framework,

investigators refrain from immediately imposing their own beliefs or conceptualizations of issues on participants (Cornwall & Jewkes, 1995). The hope is that by giving participants the opportunity to express their needs and beliefs, investigators obtain a more subject-centered perspective that leads to studies and interventions that better meet the needs of particular populations. As applied to school nurses and their perceptions of barriers to addressing weight-related health, investigators could ask open-ended questions about the barriers nurses face, rather than rely solely on pre-conceived notions of these barriers. The use of a participatory research-based method would allow both a confirmation of previously identified barriers and the identification of new barriers that will expand and contribute to the literature.

Indeed, recent work in this area indicates that current measures of barriers to providing weight-related health intervention do not fully capture the breadth of experiences reported by school nurses. Steele et al. (in press) conducted a series of focus groups to ask open-ended questions about nurses' practices related to pediatric obesity in the schools and their perceptions of barriers to addressing weight-related health among students. The results indicated a number of perceived barriers to addressing weight-related health that have not been identified in the previous literature. Specifically, nurses reported that family characteristics, such as a family's motivation to address a child's weight and whether a family views their child's weight as a problem, impeded their willingness to address weight issues with students' families. Further, nurses viewed some cultural characteristics of families (e.g., cultural differences in perceptions of normal body size) to be barriers to addressing weight. Nurses also reported that their fear of how others (e.g., school administration, parents) would react if they raised issues related to weight prevented them from addressing weight-related health with students and families. On a

societal level, nurses reported that norms such as large food portion sizes were also barriers to efforts to address pediatric weight (Steele et al., in press).

Furthermore, results from Steele et al. (in press) indicate that these barriers exist at multiple ecological levels, including at the level of individual nurses, the institutions within which they work (i.e., schools), and larger society. Individual-level barriers included nurses' self-perceived competencies in discussing weight issues with students and families and nurses' own weight (particularly, if they considered themselves to be overweight or obese). At the institutional level, nurses reported that there was a lack of support from others (e.g., administration, teachers) to address weight issues among students, and that nurses did not have time to address weight issues given their responsibilities and workload. On the societal level, as mentioned earlier, nurses reported barriers such as current norms for body size and large food portion sizes. For instance, nurses mentioned that obesity seems to be the norm rather than the exception in today's society, and that food portions are regularly provided in unhealthily large quantities (Steele et al., in press).

In contrast to Steele et al.'s (in press) findings, existing measures of nurses' perceived barriers focus primarily or exclusively on individual-level nurse barriers (e.g., nurse lack of knowledge), rather than nurses as individuals embedded within larger systems. Thus, a second limitation to existing measures is that they have not been able to assess the multi-systemic nature of barriers that nurses may perceive. Particularly in the case of pediatric obesity, a multi-systemic or ecological view is often cited as a more accurate way of conceptualizing the factors contributing to the rise and maintenance of pediatric obesity (e.g., Jelalian et al., 2008).

A third limitation of existing measures of nurses' perceived barriers is that there is limited information on the statistical development of the measures. Although Price et al. (1987)

developed their measure based on the literature and reported an estimate of internal consistency (Cronbach alpha = .80), the measure was not subjected to factor analyses to develop or confirm the measure's structure. More recent studies using the Price et al. (1987) questionnaire or variants of the original questionnaire reported overall Cronbach alphas of .74 to .77 and similarly, did not test the structure of the measure via factor analyses (Moyers et al., 2005; Nauta et al., 2009).

Kubik et al.'s (2007) questionnaire represents an advance in measure development because the measure was subjected to a principle components analysis (PCA). Unfortunately, however, the results of the PCA, which would have provided insight into the measure's validity are not presented. However, the Cronbach alpha for the section of the measure most relevant to nurses' perceived barriers was adequate ($\alpha = .75$). In sum, although existing measures have demonstrated adequate internal consistency, little is known about the construct validity of these prior measures of nurses' barriers.

The limitations noted above are striking in light of current recommendations for measure development. For example, current established methods of measure development entail utilizing factor analytic techniques to examine the underlying structure of measures, including the number of factors or constructs measures assess. In addition, current measurement studies often use statistical techniques within a structural equation modeling (SEM) framework, which provides a range of analytical tools that have advanced measure development procedures. SEM allows the specification of relationships between factors (e.g., whether factors are correlated or uncorrelated), the removal of measurement error from factor models, and the examination of fit statistics indicating how well particular models represent the data collected (DeVellis, 2003). Thus, advancements in our understanding of the statistical properties of measures are necessary,

particularly given the availability of current statistical methods that were less accessible to researchers in the past (e.g., SEM-based analyses). In addition, advancements in the development of measures assessing nurses' perceived barriers could be made by testing the construct validity of conceptualizations of nurses' perceived barriers in multiple ways (e.g., factor analyses and examining whether nurses' perceived barriers change over time). Gaining a better understanding of the barriers that school nurses perceive and developing statistically-sound measures will also answer recent calls in the literature (Nauta et al., 2009) for measures that thoroughly assess nurses' perceptions of issues related to pediatric obesity.

Finally, the use of a larger and more representative sample of school nurses in these measurement studies will be an important next step in this literature to increase generalizability. Previous samples of school nurses have primarily been convenience samples from a particular state or geographic area within a state (Kubik et al., 2007; Moyers et al., 2005; Nauta et al., 2009). A potential exception to this is Price et al.'s (1987) sample, which included 220 nurses who were members of the American School Health Association (ASHA) in 1986. However, it is unclear whether Price et al. randomly sampled nurses from ASHA and whether these nurses were distributed throughout the U.S.

Current Study

The aim of the current study was to develop a new and more comprehensive measure of school nurses' barriers to addressing pediatric weight-related health (School Nurses Attitudes and Perceptions; SNAP), and to evaluate the measure in a national sample of school nurses, using methods that more closely adhere to current recommendations for scale development (DeVellis, 2003).

Drawing on a participatory-research approach, the content of the SNAP was based on results of focus groups with school nurses (Steele et al., in press). The focus groups allowed both a confirmation of barriers assessed on existing measures (e.g., nurses' self-perceived competencies, lack of knowledge of weight-related health resources) and importantly, the identification of barriers to addressing weight issues that have not been assessed on existing measures (e.g., cultural factors influencing families' attitudes towards weight, fear of others' reactions to discussing weight issues).

In keeping with Steele et al.'s (in press) finding that school nurses perceive barriers to addressing student's weight on multiple levels within ecological systems, the SNAP was constructed to reflect three ecological levels of barriers: within-nurse barriers (e.g., knowledge, perception of the school nurse's role in addressing weight), barriers involving interactions between nurses and others (e.g., nurses' perceptions of support from others, fear of others' reactions), and barriers external to school nurses (e.g., family characteristics influencing attitudes towards weight, institutional characteristics influencing nurse workload). We hypothesized that the SNAP would reflect a higher-order factor structure corresponding to these three ecological levels (see Figure 1).

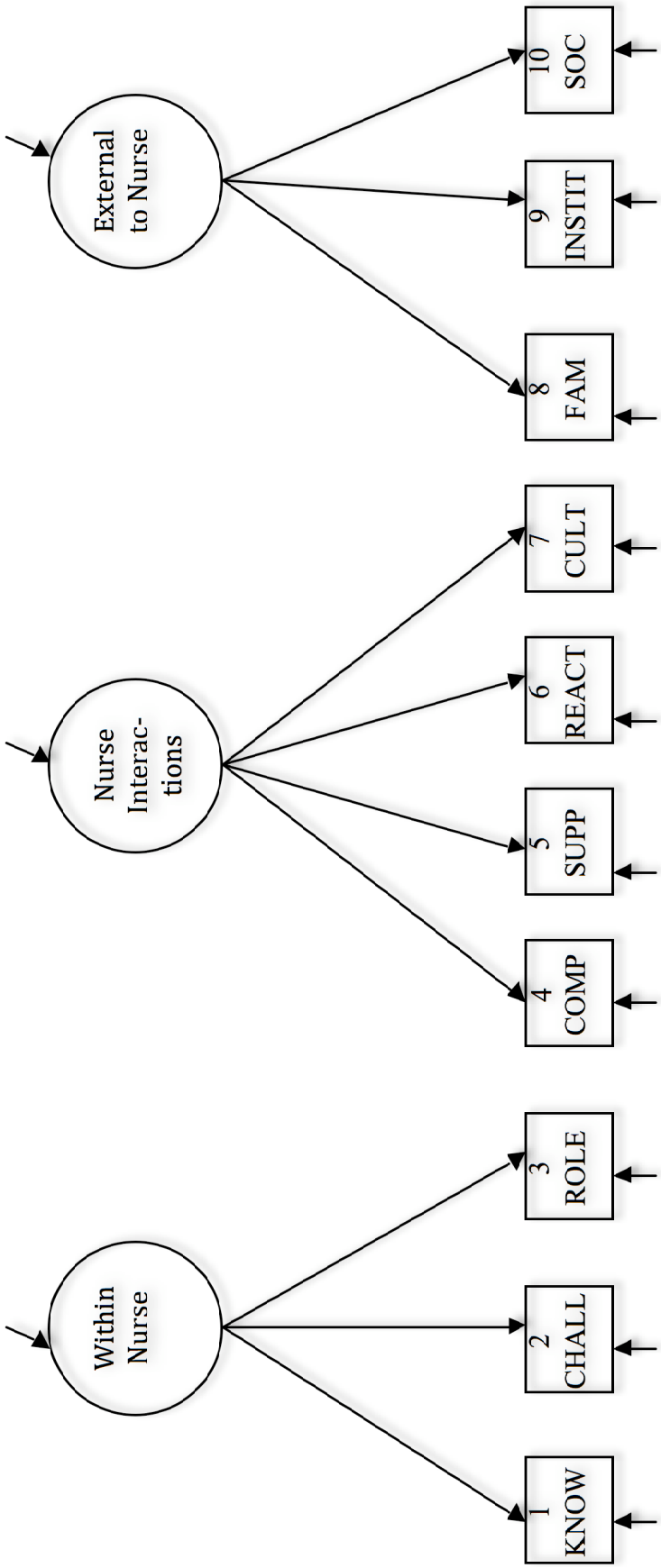


Figure 1. Hypothesized Confirmatory Factor Analysis Model

Within the three ecological levels, the SNAP was constructed to assess 10 types of barriers identified by Steele et al. (in press). We hypothesized that this lower-order measurement model would consist of the SNAP's 45 items loading on to the 10 types of barriers (see Appendix B). Specifically, we expected each item to contribute uniquely to 1 of the 10 barrier types.

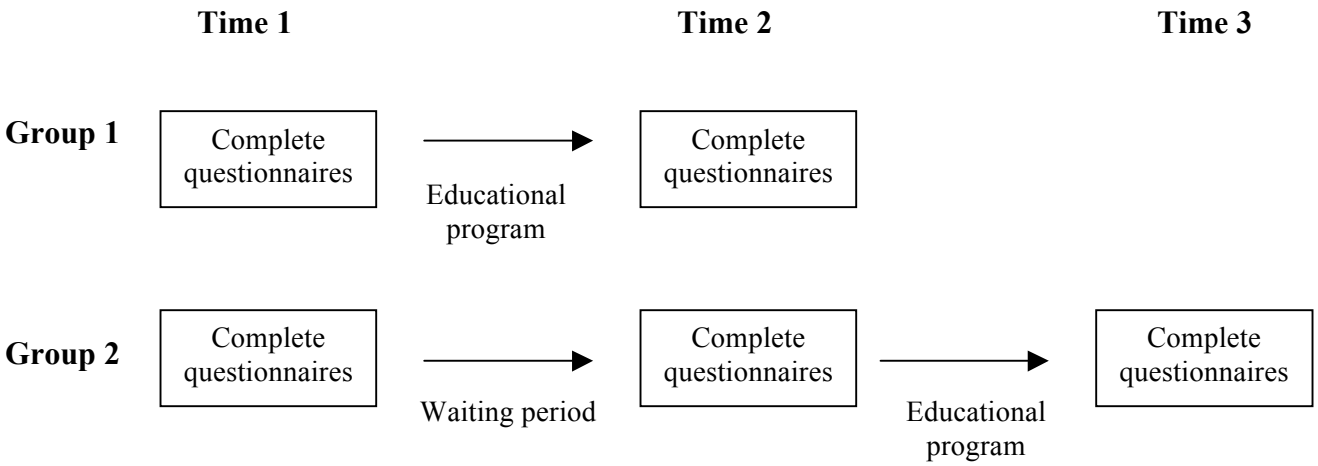
In order to examine the proposed structure of the SNAP, confirmatory factor analyses (CFAs) were conducted on both the higher-order and lower-order proposed structures. The test of the higher-order structure consisted of examining a model with three ecological levels. In addition, an alternative model with one higher-order barriers construct was tested. The model fit and modification indices were examined for the two a priori factor structures and revisions to the higher-order model were made based on exploratory factor analysis (EFA) results, modification indices, and theory stemming from previous literature. These analyses allowed a statistical test of the measure's overall structure and validity. Further, these analyses allowed a statistical examination of an ecological framework for understanding nurses' perceived barriers to addressing students' weight-related health. In addition, the lower-order model CFA for the items associated with the 10 types of barriers allowed an examination of barriers that have not been assessed on prior measures and provided information on the validity of the barrier types included on the SNAP (Brown, 2006).

To further examine and fully develop the SNAP and to allow for its eventual clinical utility, barrier scores were created for each of the 10 barrier types (subscales 1-10), the three ecological levels (subscales I, II, III), and an overall barriers total. The subscale scores for each of the 10 types of barriers were computed by averaging the item scores for each barrier. The

ecological level scores were computed by averaging across the barrier types within each level. Finally, the overall total barriers score was computed by averaging the ecological level scores.

As a means of validating the barriers measure, we also examined the change in nurses' perceptions of barriers over time, including whether their perceptions of barriers changed in response to an educational intervention designed to increase knowledge and decrease barriers. Within our study design, nurses were randomly assigned to one of two groups (immediate treatment or waitlist-control groups; see Figure 2 and the *Educational intervention* subsection, below).

Figure 2. Flowchart of Study Procedures



We first compared Group 1 and Group 2 nurses' perceptions of barriers at Times 1 and 2 and hypothesized that nurses would report significantly lower barriers only after completing the intervention (a significant group by time interaction effect such that only Group 1 nurses would report significantly lower barriers). Specifically, we anticipated that following the intervention, Group 1 nurses would perceive lower barriers related to knowledge and skills for addressing weight issues with students and families. Next, we examined the change in Group 2 nurses' perceptions of barriers across the three timepoints. We hypothesized that there would be no

significant decrease in barriers when nurses were in the waitlist phase (Times 1 to 2) and a significant decrease in barriers pre- to post-intervention (Times 2 to 3).

Method

Participants

School nurses (n = 445) located across 23 states completed the registration process and the study measures at Time 1. Nurses who participated in the study were referred by district health coordinators or nurse colleagues, or received a recruitment email based on membership in the National Association of School Nurses (see *Procedures* section). Any nurse employed in elementary, middle, or high schools, including substitute school nurses, was eligible to participate in the current study.

Table 1 provides the demographic characteristics of all nurses who completed the study measure at Time 1 and Group 1 nurses who completed the measure at Time 1. Nurses in Group 1 who completed the SNAP at Time 1 were included in the CFA (n = 214). Analyses examining the change in nurses' perceptions of barriers included nurses in Group 1 (n = 109) and Group 2 (n = 87) who completed the study measure at Times 1 and 2, and Group 2 nurses who completed the study measure at all three timepoints (n = 54).

Measures

Demographics. Nurses completed a questionnaire assessing demographic characteristics such as nurse age, ethnicity, highest nursing degree, highest registered nursing degree, highest degree outside of nursing, whether the nurse was a substitute nurse, years of school nursing experience, number of schools and students they serve, number of nurses in school district, number of nurses in the primary work environment, school type, grade levels served, and percent students receiving free and reduced lunch in the schools they serve.

Table 1.

Demographic Characteristics of Nurses who Completed Time 1, n(%) unless otherwise noted

	Groups 1 and 2 (n = 445)	Group 1 (n = 214)
Female	443 (99%)	213 (99.5%)
Average age in years (SD)	48.7 (9.5)	48.5 (9.0)
Ethnicity		
Caucasian	410 (92%)	193 (90.2%)
African-American	12 (2.7%)	7 (3.3%)
Hispanic or Latino	3 (0.7%)	2 (0.9%)
Native-American	3 (0.7%)	2 (0.9%)
Biracial	1 (0.2%)	1 (0.5%)
Asian-American	1 (0.2%)	0
Other ethnicity	15 (3.4%)	9 (4.2%)
Highest nursing degree attained		
BSN	223 (51.3%)	108 (51.9%)
ADN	95 (21.8%)	43 (20.7%)
Diploma	56 (12.9%)	26 (12.5%)
MA	59 (13.6%)	31 (14.9%)
PhD	2 (0.4%)	0
Substitute nurse	14 (3.1%)	5 (2.3%)
Number of years as a school nurse (SD)	9.4 (7.2)	9.4 (7.1)
Number of schools covered		
One	287 (67%)	138 (67%)

Two	58 (14%)	25 (12%)
Three or more	81 (19%)	44 (21%)
Primary school where nurse works		
School type		
Public	414 (93%)	199 (93%)
Private	20 (4.5%)	10 (4.7%)
Alternative	9 (2.0%)	4 (1.8%)
Magnet	1 (0.2%)	1 (0.5%)
School level		
Elementary	235 (53%)	121 (57%)
Middle	46 (10%)	21 (10%)
High	59 (13%)	29 (13%)
Combination of levels	105 (24%)	42 (20%)
Number of pupils (SD)	692 (791)	754 (912)
Pupils with free/reduced lunch	42%	45%

Note. Percentages are calculated based on the number of nurses who completed the item.

Perceived barriers. At all timepoints, nurses completed the School Nurses Attitudes and Perceptions (SNAP) measure, which assesses a wide range of nurses' perceived barriers to discussing weight-related health with students and their families (see Appendix A for the SNAP). The measure contains 45 items assessing 10 types of barriers (see Appendix B). Nurses used an on-screen visual analog scale ranging from 1 ("not a barrier") to 7 ("very much a barrier") to rate how much each item is a barrier preventing him/her from addressing pediatric weight-related health.

The SNAP was designed for the current study based on prior literature (e.g., Kubik et al., 2007; Moyers et al., 2005; Price et al., 1987) and focus group results with school nurses during the current study's initial development phase (Steele et al., in press). The barriers identified in the focus groups ranged from individual factors (e.g., self-perceived competency, nurses' own weight), to students' family factors (e.g., culture), to higher-level forces such as institutional factors and societal factors (Steele et al., in press).

Procedures

Study investigators contacted school nurses through district health coordinators in Kansas and Missouri. In addition, nurses were recruited from three other regions of the U.S.: the West (Washington, Oregon, California, Nevada, and Arizona), the South (Oklahoma, Texas, Louisiana, Mississippi, and Alabama), and the East (Maine, Vermont, Massachusetts, New York, and Pennsylvania). Nurses in these three regions were recruited from a random sample of the membership list of the National Association of School Nurses. Recruitment emails sent to school nurses provided a weblink to access the study consent and initial questionnaires administered online (Time 1). Upon this first log-in to the website, nurses registered, provided demographic information, were randomized to either Group 1 or 2, and completed the initial questionnaire.

Educational intervention. The educational intervention, *Responding to the Crisis: Equipping school nurses to facilitate change in families of overweight youth (RTC)*, is a 12-session, web-based, multimedia tutorial for school nurses that provides education on pediatric weight-related health topics and communication techniques (see Appendix C for the session outline). The *RTC* training includes text, links to research articles, videos (e.g., demonstrations of how to provide BMI results to families and demonstrations of communication techniques), PowerPoint slides, handouts to provide to families, and links to relevant websites and resources.

Nurses proceeded through the training at their own pace; however, it was recommended that they complete one session per week. Nurses also completed pre- and post-tests for all sessions, which allowed them to receive 4.8 Continuing Education credits from the University of Kansas Medical Center Area Health Education Center East for completing the training.

Completion of intervention. On average, it took Group 1 nurses 47 days to complete the training. Group 2 nurses were asked to log off the website and wait for an automated email which would invite them to return to the *RTC* website to complete the study questionnaires and begin the training program (Time 2). From September, 2009 to mid-March, 2010, an automated email was sent to a nurse in Group 2 every time a nurse in Group 1 completed half of the training sessions. From mid-March to June, 2010, all Group 2 nurses who had not yet received an automated email message were given an opportunity to begin and complete the training. On average, Group 2 nurses who completed the training waited to begin the training for 115 days. On average, Group 2 nurses took 30 days to complete the training. Following completion of the *RTC* training, nurses were asked to complete an online questionnaire (Time 2 for Group 1 nurses and Time 3 for Group 2 nurses). Group 2 nurses were eligible to receive a $20 gift card as a token of appreciation for completing questionnaires at an extra timepoint (Time 3) and for waiting to complete the training.

Data Analysis

All CFA analyses were run in LISREL 8.7 using half of the sample (i.e., Group 1 nurses; Brown, 2006; Jöreskog & Sörbom, 2004). The EFA was run in SAS 9.2. Preliminary analyses determined whether nurses' perceived barriers varied by demographic variables, such as years of experience and school district. Analyses to examine the change in nurses' perceived barriers were carried out using multivariate analysis of variance (MANOVA) and general linear model

repeated measures analyses in SPSS 17.0. In the MANOVA, the dependent variables were perceived barriers at two timepoints (Time 1 and Time 2) and the independent variable was group (Group 1 or 2). The repeated measures analysis was used to examine the change in barriers among Group 2 nurses at Times 1, 2, and 3. Responses from nurses who participated in the focus groups (n = 2) were excluded from the MANOVA and repeated measures analyses.

Power analysis. A priori power analyses using G-Power 3 indicated that with an alpha level of .05 and 80% power, the current study required between 52 to 128 participants to detect a medium to large effect for the MANOVA described above, and 12 to 28 participants in Group 2 to detect a medium to large effect for the repeated measures analysis. Based on our a priori estimated effect sizes derived from the literature, the final sample size of 196 nurses (109 in Group 1 and 87 in Group 2) afforded a 94% chance of detecting a medium effect size for the MANOVA and a 99% chance of detecting a large effect size. In addition, the final sample size of 54 nurses for the repeated measures analysis had a 98% chance of detecting a medium effect size and a 99% chance of detecting a large effect size.

Missing Data

The computerized SNAP did not allow nurses to advance through the measure until all items on the current page were completed. However, technological problems or other interruptions prevented some nurses from completing the entire SNAP (e.g., a nurse may be timed-out of a session if inactive for a length of time). Group 1 nurses had 4.4% missing data and Group 2 nurses had 4.7% missing data at Time 1. Because the pattern of missing data for nurses who completed at least one page of the SNAP appeared to be missing completely at random (MCAR) based on the Little MCAR test (Little, 1988), and the data showed a monotone pattern of missingness, a single imputation using expectation maximization/Markov Chain Monte Carlo

(EM/MCMC) was implemented prior to the CFAs using LISREL 8.7 (Jöreskog & Sörbom, 2004). Imputation is preferred over list-wise deletion in order to maintain power and decrease sample bias (Buhi, Goodson, & Neilands, 2008). For the MANOVA and repeated measures analyses, a single imputation using EM/MCMC was completed before carrying out the analyses.[1]

Some nurses who completed Time 1 measures did not complete the subsequent measure(s). Specifically, Group 1 had an attrition rate of 47%. Group 2 had an attrition rate of 69% from Time 1 to 2 and an attrition rate of 16% from Time 2 to 3. The attrition rate for Group 2 from Time 1 to Time 3 was 74%. There was one significant difference (in terms of demographic characteristics, barriers subscale and total barriers scores) between nurses who completed only the Time 1 questionnaire (non-completers) and nurses who completed the questionnaire at both Times 1 and 2 (completers). Specifically, Group 2 nurses were more likely to complete only the Time 1 questionnaire ($X^2(1, n = 477) = 9.9, p = .002$). There were no significant differences between Group 2 nurses who completed the measure at all three timepoints and Group 2 nurses who only completed the measure at Time 1.

Results

Confirmatory Factor Analyses

CFAs were used to evaluate the hypothesized lower- and higher-order structures of the SNAP. For the lower-order structure (45 items loading on 10 barriers constructs), the fit indices indicated that the hypothesized loadings were reasonable and valid (CFI = .889, NNFI = .878, RMSEA = .073). Specifically, a CFI or NNFI between .85 and .90 and an RMSEA between .01 and .08 indicates mediocre to adequate model fit (see Brown, 2006, for a review).

[1]Because the computer system only saved nurses' SNAP responses if they completed the first page of the measure, only nurses who completed at least the first page at Time 1 and Time 2 (for the MANOVA) and Group 2 nurses who completed at least the first page at Times 1, 2, and 3 (for the repeated measures analysis), were included in the analyses.

Next, CFAs were used to examine the fit of the models where the 10 types of barriers loaded on the hypothesized higher-order constructs. The hypothesized higher-order CFA examined whether the 10 barriers constructs loaded on the three ecological level constructs which consisted of within-nurse barriers (e.g., lack of knowledge about weight-related health resources for students), interaction barriers (e.g., fear of others' reactions if weight issues were discussed), and external barriers (e.g., societal-level barriers such as food portion sizes). The fit for this CFA was poor by all indices (CFI = .635, NNFI = .612, RMSEA = .140). The fit for the alternate higher-order CFA where the 10 barriers constructs loaded onto one overall barriers construct also had poor model fit by all indices (CFI = .602, NNFI = .583, RMSEA = .145). Together, these results indicated that although the hypothesized relationships between the questionnaire items and barriers types were valid (i.e., lower-order structure), the a priori higher-order structures were not.

Exploratory Factor Analysis

Because the fit for the higher order CFAs was poor and for measure development purposes (Holmbeck & Devine, 2009), an EFA of the lower-order model correlations (10 barriers constructs) was conducted. The EFA used the maximum-likelihood method of estimation and a Harris-Kaiser oblique rotation method. Both the 3- and 4-factor solutions were reasonable using a scree plot; however, the 3-factor solution was more theoretically sound. Specifically, one factor (SKILLS) contained constructs related to nurses' perceptions of their own skills or knowledge deficits. A second factor (JOB) contained barriers constructs related to their workplace (e.g., support from others to discuss weight-related health, institutional-level barriers to discussing weight-related health). A third factor (BIGFACT) contained constructs related to forces outside of the nurse's control, such as societal-level phenomena (e.g., large

portion sizes) and characteristics of students' families (e.g., family has limited resources to address child's weight).

To confirm this factor structure, a higher-order CFA was conducted with the 3 higher-order factors identified in the EFA. This CFA was then modified in several ways: (a) loadings that were not supported by theory and the prior literature were pruned, (b) latent variable residual variances were allowed to correlate if modification indices were large and if theory supported the correlation, and (c) a 'methods' factor was added to account for method-specific variance among certain constructs. The final CFA had mediocre to close fit (CFI = .973, NNFI = .949, RMSEA = .088; see Figure 3).

Development of Subscale Scores

Scale scores were created for the barrier types (subscales 1 through 10) by averaging across items for each barrier type. On the higher-order, ecological scale level (subscales I, II, III), scores were computed by averaging across the barrier type scores loading onto each higher subscale. For the barrier type subscales that loaded onto more than one higher-order construct in the CFA (i.e., subscales 4 and 7), theory was used to determine which higher subscale they should load onto. That is, each barrier type score (subscales 1-10) loaded onto only one higher subscale (I, II, III). Finally, a "total barriers score" was computed by averaging the lower subscale scores. See Table 2 for a list of which lower subscales comprised the higher subscales and Table 3 for subscale and total score reliability coefficients. See Table 4 for mean levels of barriers at each timepoint. Subscale scores and the total barriers score could range from 0 to 7 with greater scores indicating higher perceived barriers.

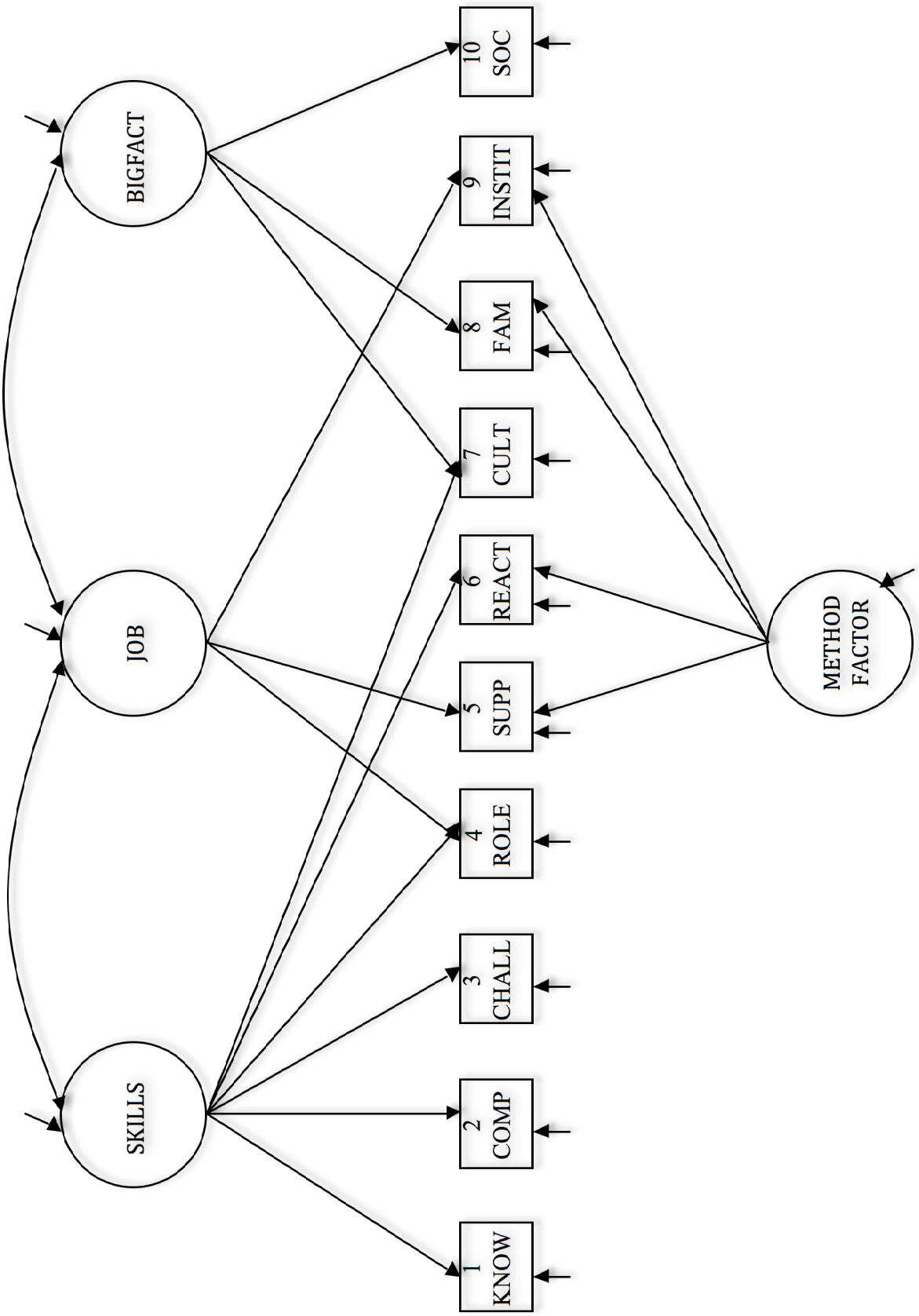


Figure 3. Final Confirmatory Factor Analysis Model

Table 2.

Loadings of Lower Order Subscales (LOS) onto Three Higher Order Subscales

LOS Number	LOS Name	SKILLS (I)	JOB (II)	BIGFACT (III)
1	Knowledge/resources	X		
2	Competence	X		
3	Personal challenges	X		
4	Nurse role		X	
5	Perceived support		X	
6	Fear of reactions	X		
7	Cultural differences			X
8	Family characteristics			X
9	Institution characteristics		X	
10	Societal characteristics			X

Note. Loadings are denoted by an X.

Table 3.

Subscale and Total Score Reliability

Score	Time 1		Time 2		Time 3	
	Grp 1	Grp 2	Grp 1	Grp 2	Grp 1	Grp 2
Skills	.88	.88	.90	.89	-	.94
Job	.82	.84	.84	.86	-	.92
Big factors	.86	.86	.90	.85	-	.92
Total	.91	.93	.94	.93	-	.97

Table 4.

Mean Levels of Barriers (SD) and Group Comparisons at Time 1 (T1) and Time 2 (T2)

				T1 (Grp 1 vs. 2)		T2 (Grp 1 vs. 2)	
	Time 1	Time 2	Time 3	*F*	*p*	*F*	*p*
Skills							
Group 1	3.07 (0.96)	2.58 (0.94)	-	0.84	.360	29.82	<.001
Group 2	3.17 (1.05)	3.33 (0.98)	2.67 (1.07)	-	-	-	-
Job							
Group 1	3.02 (0.92)	2.78 (0.89)	-	1.55	.215	12.15	.001
Group 2	3.06 (1.01)	3.27 (0.99)	2.95 (1.17)	-	-	-	-
Big factors							
Group 1	4.45 (1.02)	3.71 (1.01)	-	2.46	.119	21.20	<.001
Group 2	4.36 (1.02)	4.36 (1.02)	3.70 (1.15)	-	-	-	-
Total							
Group 1	3.47 (0.75)	2.98 (0.79)	-	0.10	.754	30.46	<.001
Group 2	3.49 (0.87)	3.63 (0.83)	3.07 (1.01)	-	-	-	-

Note. Degrees of freedom (hypothesis, error) = (1, 194)

Change in Barriers

Before examining the degree to which SNAP scores were responsive to the educational intervention noted above, MANOVA and correlational analyses were conducted to determine whether any demographic variables or other characteristics should be included in the analyses. The results indicated that there were no statistically significant associations between demographic variables (i.e., nurse age, ethnicity, highest nursing degree, highest registered

nursing degree, highest degree outside of nursing, whether the nurse was a substitute nurse, years working as a school nurse, number of schools in which the nurse worked, number of nurses in school district, number of nurses in the primary work environment, percent of students receiving free or reduced lunch, number of students, school type, grade levels served) and the higher level barriers subscales at all timepoints. As a result, no demographic variables were controlled for in subsequent analyses. In addition, number of days to completion of the tutorial was not significantly correlated with the barriers subscales or total score at any time point. Further, there were no significant differences between Group 1 and Group 2 nurses at Time 1 on any demographic variables.

To examine change in barriers over time, four MANOVAs were conducted; one MANOVA for each of the three higher level barriers scores (I, II, III) and one MANOVA for the total barriers score. The results of the MANOVA with group as the independent variable and barriers subscales and total score at Times 1 and 2 as the dependent variables were significant. Specifically, the Wilks' Lambda multivariate test of overall differences among groups was statistically significant for all barriers subscales and the total barriers score (see Table 5).

Table 5.

MANOVA Results

Barrier type	Wilk's λ	*F*	*p*	Partial Eta-Squared
Skills	0.83	19.77	<.001	0.17
Job	0.93	6.79	.001	0.07
Big factors	0.83	19.17	<.001	0.17
Total	0.82	20.96	<.001	0.18

Note. Degrees of freedom (hypothesis, error) for all = (2, 193)

As hypothesized, there was a group by time interaction effect such that there was a significant change in barriers for Group 1 nurses, but not Group 2 nurses. Post-hoc univariate analyses revealed that the mean level of barriers did not significantly differ between groups at Time 1, but did at Time 2 (see Table 4).

The results of the repeated measures analyses examining Group 2 nurses' change in barriers in the three higher level barriers scores and the total barriers score across the three timepoints indicated that there was a main effect for time (see Table 6). Specifically, there was no significant change in barriers from Time 1 to 2 and there was a significant decrease in nurses' perceived barriers from Time 2 to 3 (see Table 6).

Table 6.

Group 2 Repeated Measures Analyses and Change in Barriers Across Timepoints (T1, T2, T3)

Barrier Type	Wilk's λ	*F*	*p*	Partial Eta-Squared	T2 – T1 barriers	*p*	T3 – T2 barriers	*p*
Skills	0.57	19.62	<.001	0.43	.21	.108	-.67	<.001
Job	0.85	4.46	.016	0.15	.19	.133	-.30	.006
Big factors	0.66	13.32	<.001	0.34	.04	.763	-.70	<.001
Total	0.59	17.44	<.001	0.40	.15	.171	-.57	<.001

Note. Degrees of freedom (hypothesis, error) for repeated measures analyses = (2, 52). Statistical significance tests for change in barriers across timepoints are based on pairwise comparisons between estimated means.

Discussion

The current study was designed to address three key limitations in the literature. First, the study focused on the development of a measure (the SNAP), based on our earlier work (Steele et al., in press), that provided a more comprehensive assessment of school nurses' perceived barriers. Second, whereas the prior literature has not always recognized the ecological nature of nurses' barriers, the SNAP was designed to assess perceived barriers within multiple ecological levels. Third, the present study more closely adhered to current recommendations for the statistical development and validation of measures (DeVellis, 2003).

The results of the current study supported our hypothesized measurement model of nurses' perceptions of barriers to discussing weight-related health with students and their families. The higher-order (i.e., ecological-level) model results confirmed that nurses perceive a range of barriers spanning multiple levels, including nurse-level skills barriers (e.g., skills for talking with families about weight issues), job-level barriers (e.g., perceptions of the school nurse's role in addressing students' weight issues, perceived support for addressing weight issues), and higher-level barriers over which nurses have less control (e.g., family attitudes towards weight, societal norms related to eating and weight). This final subscale-level model, however, did not support the two a priori higher-order factor structures.

The current study provided initial evidence for the validity and reliability of the SNAP for assessing school nurses' perceptions of barriers to addressing weight issues with students and families. First, the CFA results provided support for the construct validity of the measure. Specifically, the fit statistics for the final measurement model and higher-order model indicated that the proposed models are accurate descriptions of the factor structure of the SNAP given the data gathered. In addition, the SNAP subscales demonstrated high reliability at all time points

and across groups. The development of a statistically-sound measure (e.g., through the use of factor analyses) answers calls in the literature for improved assessments of school nurses' attitudes related to pediatric obesity (Nauta et al., 2009) and more closely adheres to existing recommendations on measure development (DeVellis, 2003). Beyond the statistical development and properties of the SNAP, the measure also adds to the literature by providing an assessment of multiple ecological factors that may affect school nurses' willingness to address pediatric weight issues. This ecological or systems assessment is likely a more valid and accurate representation of the barriers that school nurses face, compared with assessments focused on individual nurse-level barriers alone (Denehy, 2002). Furthermore, this ecological perspective parallels current conceptualizations of the multi-systemic factors contributing to pediatric obesity (e.g., Jelalian et al., 2008).

Second, as hypothesized, there was a significant change in nurses' perceptions of barriers following the intervention. Specifically, nurses perceived significantly lower barriers to discussing weight issues with students and families only after completing the intervention and not during the waitlist phase. The change in nurses' perceived barriers provides further support for the validity of the SNAP, even beyond the factor analyses conducted. No other measures of school nurses' perceived barriers have yet been validated in this way.

Despite the differences between the statistical development of the SNAP and that of previous measures, some barriers assessed by the SNAP are consistent with those identified using existing measures. For example, nurses reported not feeling competent to recommend weight loss programs to children and their families, not having time to address weight issues with students, not having the skills or resources to address weight issues with students and families, and not perceiving other school staff (e.g., teachers, food service staff) and school

administration to be supportive of efforts to address student's weight (Kubik et al., 2007; Moyers et al., 2005; Nauta et al., 2009; Price et al., 1987). Thus, the results of the current study are consistent with prior theory concerning nurses' attitudes and perceptions of barriers to addressing pediatric weight and support the validity of barriers assessed on existing measures.

One of the strengths of the SNAP, however, is that it assesses additional types of barriers which have not yet been identified or measured in previous studies (e.g., Kubik et al., 2007; Moyers et al., 2005). For instance, nurses reported in the current study that barriers to addressing students' weight include family culture and other family characteristics (e.g., willingness to discuss weight issues), fear of others' reactions (e.g., students, parents, school administration), and societal-level influences (e.g., large portion sizes). In particular, the SNAP's assessment of cultural barriers and family characteristics is important given that rates of obesity differ between ethnic groups and that aspects of culture and families are related to behaviors contributing to obesity (Ogden et al., 2010). For instance, cultural factors such as social norms for body size and perceived control over weight, as well as family behaviors such as feeding habits and parenting styles can be related to obesity (see Wilson & Kitzman-Ulrich, 2008, for a review).

The newly-identified barriers on the SNAP have also been identified in a small, related literature examining nurses' perceptions of the barriers to and benefits of measuring students' BMIs. Specifically, findings from two studies indicated that nurses reported barriers to measuring BMI such as potential parent and student responses, policy factors, and societal factors (Hendershot, Telljohann, Price, Dake, & Mosca, 2008; Stalter, Chaudry, & Polivka, 2010). For example, nurses reported that because they were concerned about how parents and students may respond to feedback about high BMI status, nurses often referred students for treatment of comorbid health conditions (e.g., hypertension) rather than weight (Stalter et al.,

2010). Regarding the role of policies, nurses reported that policies mandating BMI screening would increase their confidence in regularly assessing students' BMIs and enable them to prioritize BMI screening among their other responsibilities (Stalter et al., 2010). Nurses in both studies also reported societal-level barriers to BMI screening such as the prevalence of the culture of fast food, and public opinion (i.e., opposition) regarding BMI screening in schools. It perhaps is not surprising that nurses perceive similar barriers to both BMI screening and addressing weight-related health with students and families because BMI screening is one avenue through which nurses can communicate weight-related information to families.

Moving beyond the school nurse literature, the barriers assessed on the SNAP are also consistent with those assessed by measures used with physicians and other health care professionals. For instance, Perrin and colleagues (2005) and Story et al. (2002) reported that health care professionals (e.g., pediatricians, nurse practitioners, dietitians) perceived a range of barriers to addressing pediatric obesity. These barriers included the professional's knowledge and skills, referrals and educational materials available, child and family characteristics (e.g., motivation, perception that weight is a problem), fear of offending child/family, and higher-level factors such as fast food and features of the school environment (e.g., available food, physical activity options). Taken together, these findings and the current study's findings, suggest that health care professionals working in a variety of systems perceive similar barriers to addressing pediatric weight-related health and particularly, obesity. Although there are unique demands and considerations for different professionals and depending on the system within which they practice, interventions or education efforts that are effective with certain health care professionals (e.g., physicians) could be modified and used with other health care professionals (e.g., nurses). For example, a variety of health care professionals may benefit from receiving

information on obesity treatment referrals in their area, ways to assess for obesity, methods of communicating these results to families, and more generally, skills (e.g., motivational interviewing skills) that enable professionals to effectively engage families in discussions about weight-related health.

Of note among the results from the current study is that nurses reported significantly lower barriers on all of the SNAP barriers subscales, even in areas beyond the primary focus of the intervention (i.e., nurse skills and knowledge related to addressing pediatric obesity). For example, nurses reported significantly lower barriers on factors typically outside the immediate control of school nurses (e.g., job-related barriers, cultural factors influencing weight, societal norms and practices related to weight). Although the intervention program included some content related to higher-level issues (e.g., addressing families' cultural values related to food and weight, joining with other professionals who are invested in addressing youth weight), it is notable that even with this limited content, nurses' perceptions of job- and higher-level barriers were significantly lowered following the intervention. These findings suggest that when nurses are provided with knowledge and skills relevant to pediatric weight issues, their perceptions of barriers that prevent them from addressing weight in their students can be lowered in a wide range of areas and on multiple levels. Furthermore, the Diffusion of Innovations theory would suggest that the increase in knowledge and skills that nurses reported may improve their ability to implement better assessment and intervention methods for student's weight (Rogers, 2003). Whether nurses' practices and behaviors do, in fact, change, will need to be addressed in future studies.

Although nurses perceived lower barriers following the intervention across the three subscale domains, the largest effects were seen for knowledge and skills barriers as well as for

higher-level barriers such as family characteristics and societal-level phenomena (e.g., food portion sizes). As may be expected, there was a smaller effect for the decrease in nurses' perceptions of job-related barriers (e.g., school nurse's role in addressing obesity, perceived support, institutional characteristics). An intervention such as the one in the current study that focuses on school nurses would not be expected to immediately alter aspects of the school environment that make it difficult for nurses to address students' weight (e.g., others' support for addressing weight and school characteristics). However, this finding suggests that school nurses may benefit from additional support in their workplace for addressing obesity with students and families. For example, nurses may benefit from school-wide initiatives to address student's weight-related health that involve multiple members of the staff and administration.

The results of the current study should be interpreted with several limitations in mind. Because of the attrition rates for both treatment groups, and particularly for Group 2, it is possible that the nurses who completed the intervention and study questionnaire were different from nurses who did not complete the intervention. Although analyses indicated that there were few demographic differences between completers and non-completers, it is possible that these two groups differed on some other variable that was not measured. In addition, further research including nurses in other states (other than the 23 that were represented in the current sample) and focusing on states that have enacted legislation addressing pediatric weight is needed. It remains to be seen whether larger policies, such as legislation requiring nurses to assess student BMI and communicate this information to families, provide an environment within which nurses are more likely to discuss weight-related health with students and families. Policies such as ones mandating nurses to communicate BMI information to families may lower larger-level barriers that currently prevent nurses from addressing weight with students and families on a routine

basis. Similarly, drawing from the Diffusion of Innovations theory as applied to organizations (e.g., school systems, schools operating within states), it will be important for future research to examine how individuals within organizations (e.g., nurses within schools) implement the large-scale policies, what their attitudes towards these policies are, and in the case of school nurses, the extent to which these policies impact perceived barriers to addressing weight issues among students (Rogers, 2003). It is encouraging, however, that initial evidence from focus groups suggest that nurses appreciate larger level policies mandating BMI screening (Stalter et al., 2010).

Finally, because nurses volunteered to participate in the current study, it is possible that there was a participation bias such that nurses who were more interested or invested in pediatric weight issues were more likely to participate. However, the continuing education credits which nurses were eligible to receive (free of charge) if they completed the educational program may have lessened this potential participation bias. Future studies might examine mandated programs for school nurses and compare whether similarly positive results are achieved.

The current study also had several notable strengths. First, results of focus groups with school nurses were used to identify barriers that may prevent nurses from discussing weight issues with students and families. This preliminary work then informed the development of the SNAP, which assessed nurses' barriers at multiple ecological levels. In contrast, measures in the prior literature examined barriers that investigators identified based on their expertise, existing position statements, and the research literature and focused on individual nurse-level barriers (e.g., Kubik et al., 2007; Price et al., 1987). Second, the current study examined the SNAP's validity (i.e., via CFAs and change in barriers following intervention) and reliability (i.e., internal consistency). The results supported both the validity and reliability of the measure. And

third, nurses participating in the current study were drawn from a national sample of school nurses, thus increasing the generalizability of the findings.

Future research with school nurses might build on the findings of the current study by testing the SNAP in other samples of school nurses (i.e., investigating whether the factor structure is consistent across samples), and examining the relationship between the SNAP and other measures of nurses' attitudes towards pediatric weight issues. If future studies also demonstrate that the SNAP has adequate psychometric properties, it may be a useful tool for researchers, clinicians, and school districts aiming to engage school nurses in interventions targeting students' weight-related health. The SNAP could be used throughout the phases of developing and implementing interventions so that they are tailored to meet nurses' needs. For example, the measure could be administered during development of the intervention to identify the most salient barriers that nurses perceive. These barriers could then be addressed directly in an intervention for nurses or when engaging school nurses in implementing student-focused interventions. The SNAP could also be administered during the intervention to monitor nurses' perceptions of barriers as they move through or implement interventions. Nurses could also be asked to complete the SNAP following interventions and during maintenance phases to monitor relationships between perceptions of barriers and behavior changes, and to investigate nurses' long-term perceptions of barriers.

It will be important to examine whether nurses' perceived barriers (e.g., on the SNAP) predict their behaviors related to addressing student's weight (e.g., counseling families, measuring BMI) and ultimately child outcomes (e.g., BMI, health). Encouragingly, existing research with school nurses suggests that perceptions of certain barriers or responsibilities may be related to nurses' behaviors. Nauta et al. (2009) reported a positive correlation between the

frequency of nurses' discussions with parents about students' weight issues and how strongly nurses believed it was within their job responsibilities to discuss weight issues with parents. In addition, other literature on the relationship between barriers and health behaviors indicate that lowering individuals' barriers to engaging in certain health behaviors (e.g., providing families with knowledge on what asthma medications to use and when) may lead to behavior changes that render improved outcomes (e.g., fewer asthma exacerbations requiring medical care; Rachelefsky, 2007). Future research may also examine whether changes in perceived barriers and changes in behaviors are maintained long-term.

Given the results of the current study, future school-based, pediatric weight programs that involve school nurses might consider using the SNAP to assess nurses' perceptions of barriers. In addition, the current results suggest that it is possible to lower school nurses' perceptions of barriers at multiple levels to addressing pediatric weight-related health. The findings thus support the notion of using a socioecological approach to addressing pediatric obesity (e.g., Jelalian et al., 2008) and engaging professionals from multiple disciplines and settings. Future programs will need to tailor their content and format to meet the needs, perceived barriers, and abilities of professionals from different disciplines. In addition, future research might investigate whether interventions at multiple ecological levels differentially impact perceptions of barriers and individuals' practices. Ultimately, the hope is that by coordinating more comprehensive and effective efforts to engage professionals, youth, and families on issues around weight, a larger number of children will experience improved physical and psychosocial health outcomes.

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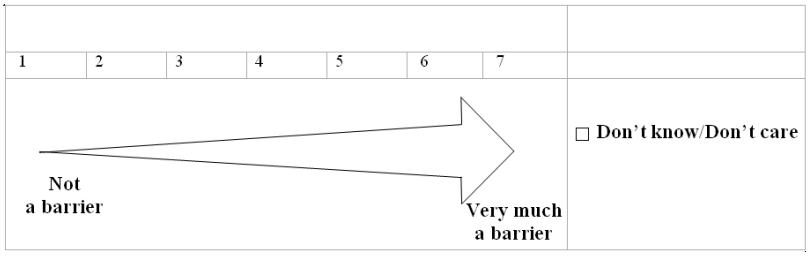
Appendix A

School Nurse's Attitudes and Perceptions (SNAP)

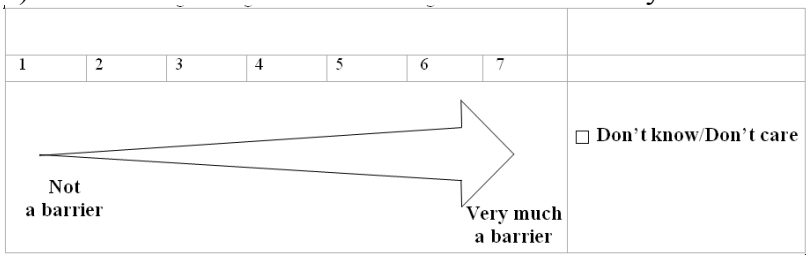
School nurses have a range of job responsibilities. Addressing student's weight-related health may be one such responsibility. We would like to learn about the factors that make it difficult for you or prevent you from addressing student's weight-related health.

To what degree are these barriers that prevent you from addressing student's weight-related health…

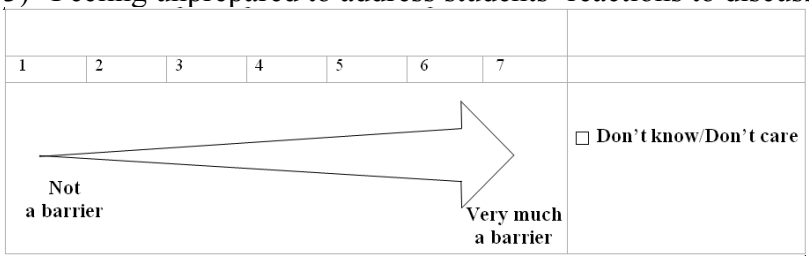
1) Being unfamiliar with local pediatric weight programs to which I can refer students and families.



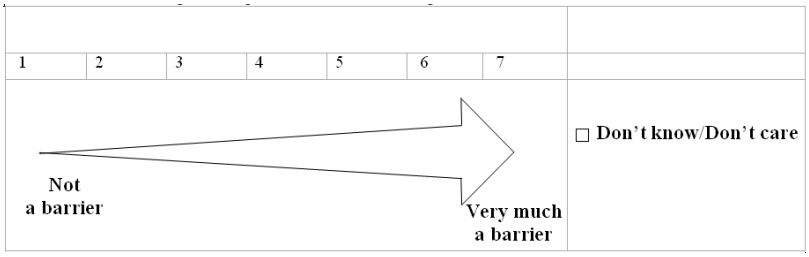
2) Food available to students in school not healthy.



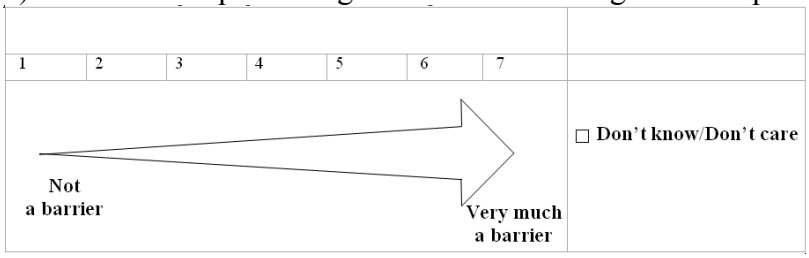
3) Feeling unprepared to address students' reactions to discussing their weight.



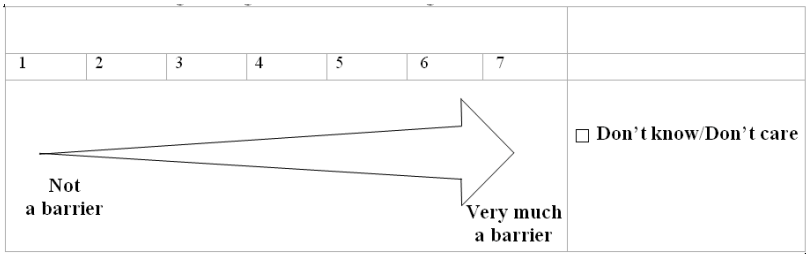
4) Worrying about families' reactions if I initiate discussion about their child's weight-related health.



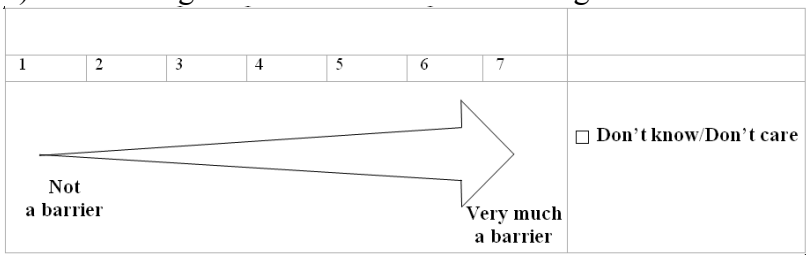
5) Families not perceiving their children's weight to be a problem.



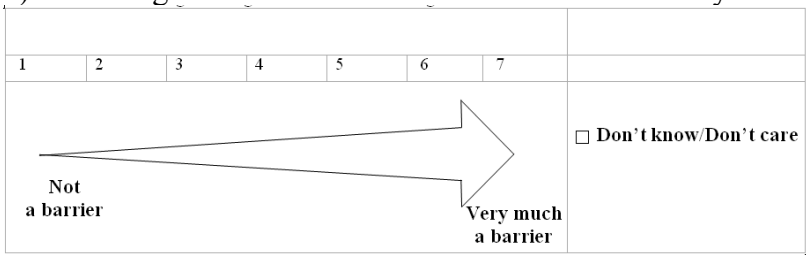
6) My district nurse supervisor not supporting my efforts to address student's weight-related health.



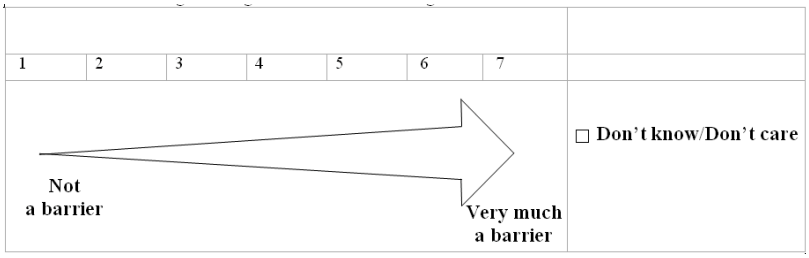
7) Not having time to address student's weight-related health.



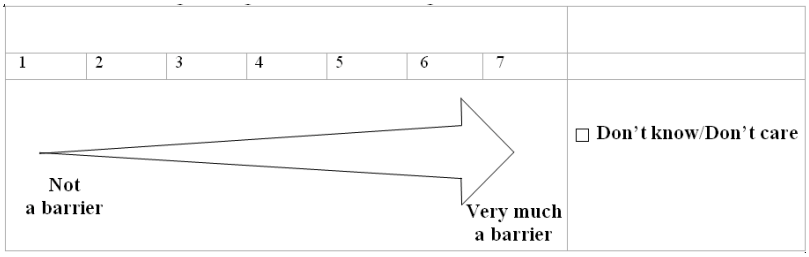
8) Thinking that I should be a role model to students by maintaining a healthy weight.



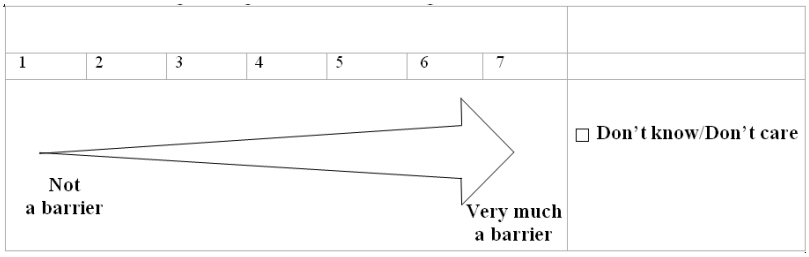
9) Being unfamiliar with cultural practices and attitudes towards weight different from my own.



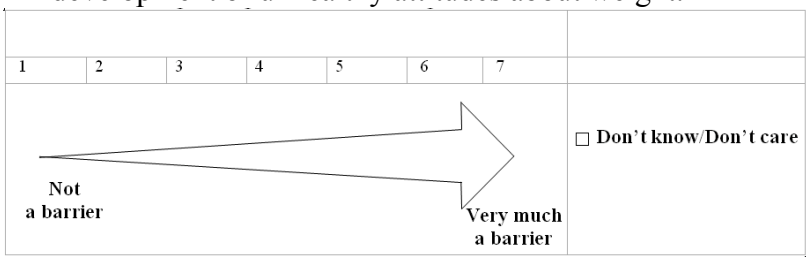
10) As a school nurse, not being obligated to discuss weight-related health with students and their families.



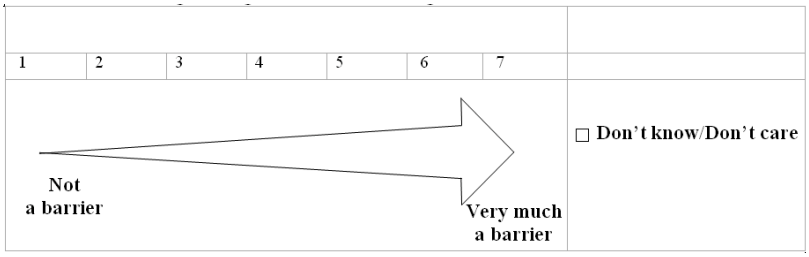
11) School food service staff not supporting my efforts to address student's weight-related health.



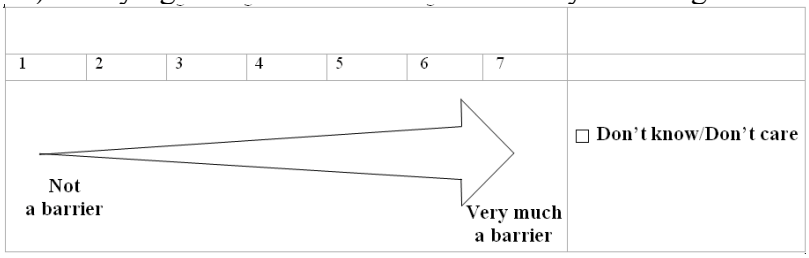
12) Worrying that discussing weight-related health with students may contribute to the development of unhealthy attitudes about weight.



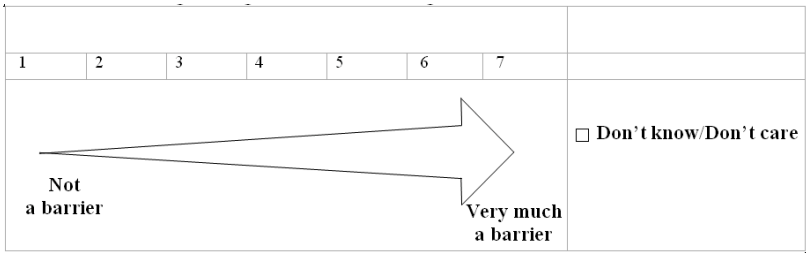
13) The state government not supporting my efforts to address student's weight-related health.



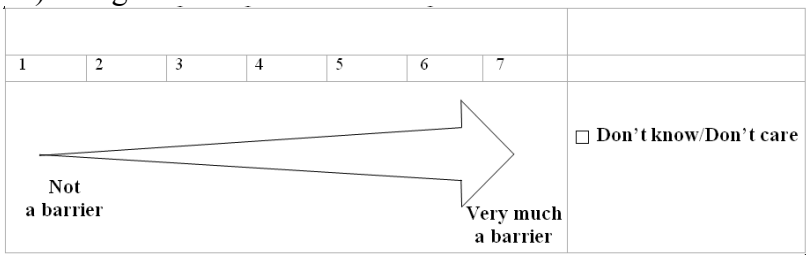
14) Worrying about students' reactions to my initiating discussion of weight-related health.



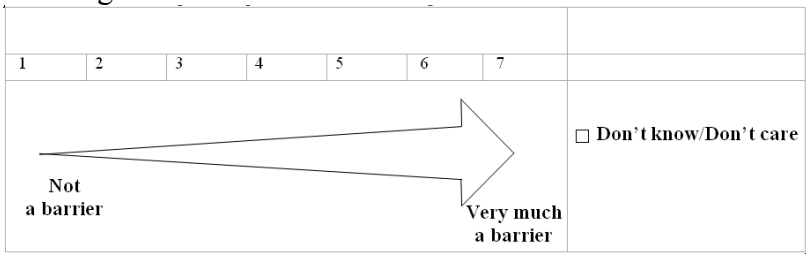
15) Not having control over important contributors to pediatric overweight, such as large portion sizes in restaurants and advertisements for unhealthy foods.



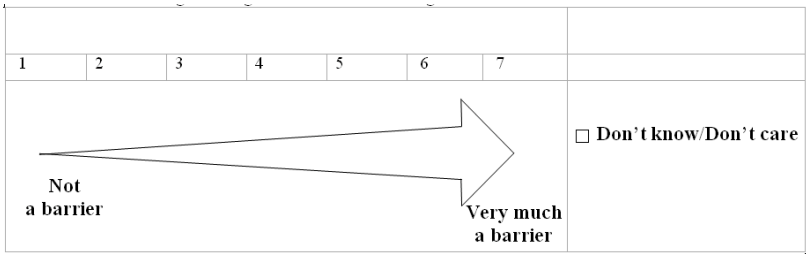
16) Being unfamiliar with the traditional foods of different cultures.



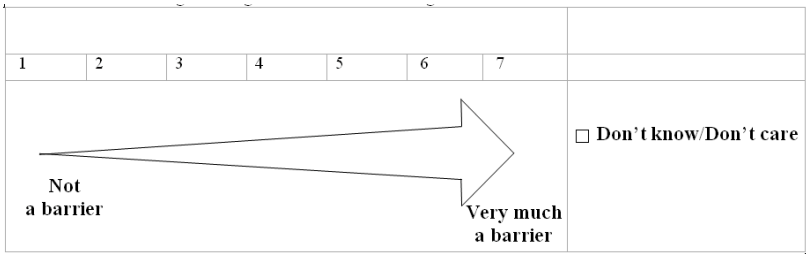
17) Worrying about the school administration's reactions to my efforts to address student's weight-related health.



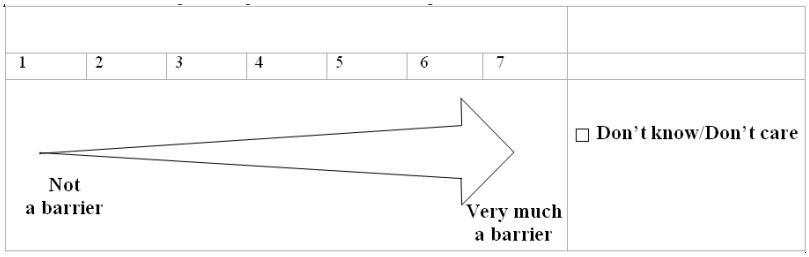
18) Not having resources on weight-related health, such as handouts, to share with students and families.



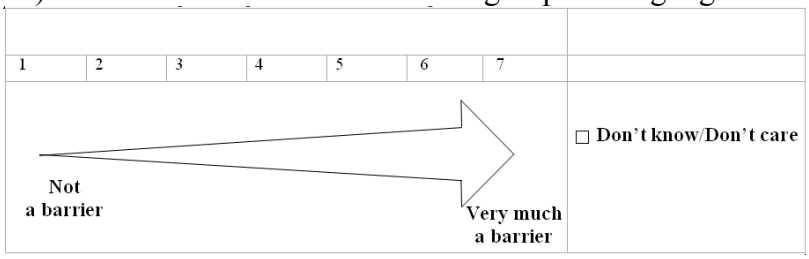
19) Not feeling competent to address psychological issues that overweight students may have.



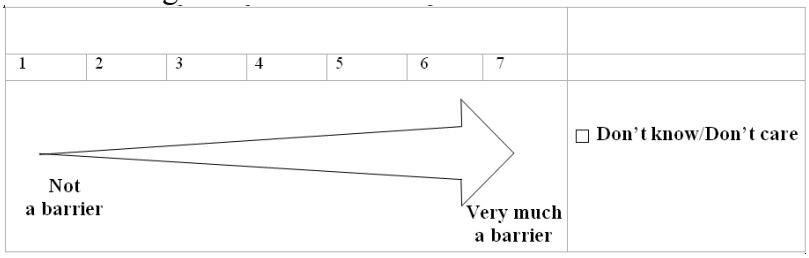
20) Struggling with the same weight-related issues that overweight students and their families struggle with.



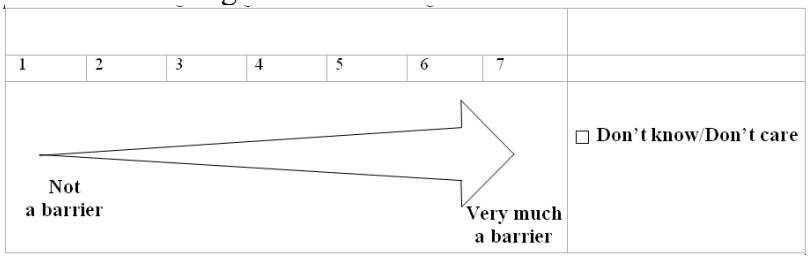
21) Some students'/families' cultural groups having higher rates of overweight.



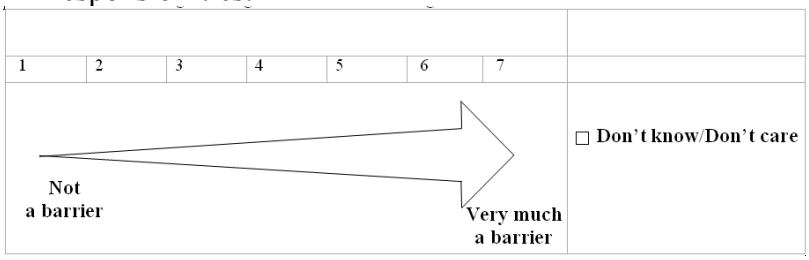
22) Families with limited resources (e.g., money and time) not being able to follow through with weight-related recommendations.



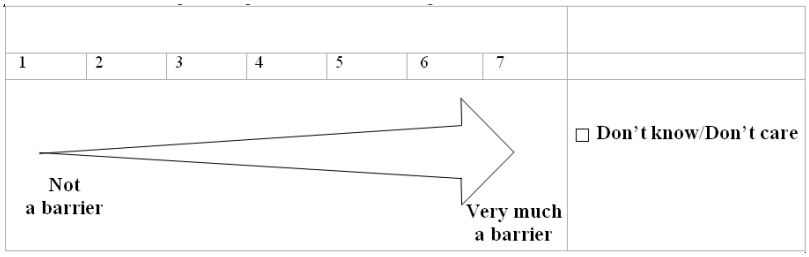
23) Due to policies such as No Child Left Behind, not having enough resources to address student's weight-related health.



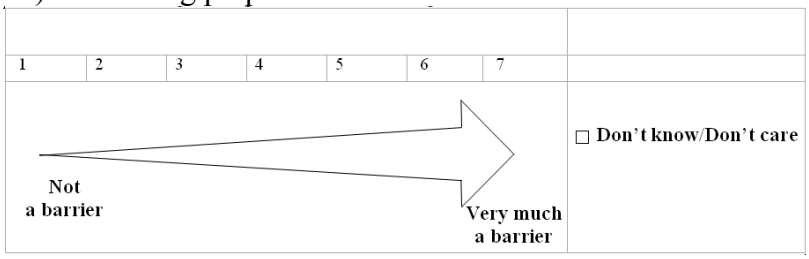
24) Addressing weight-related health with students or their families not being within my job responsibilities.



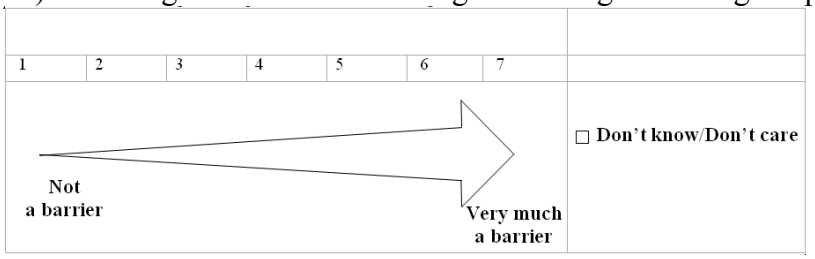
25) Students' families not supporting my efforts to address student's weight-related health.



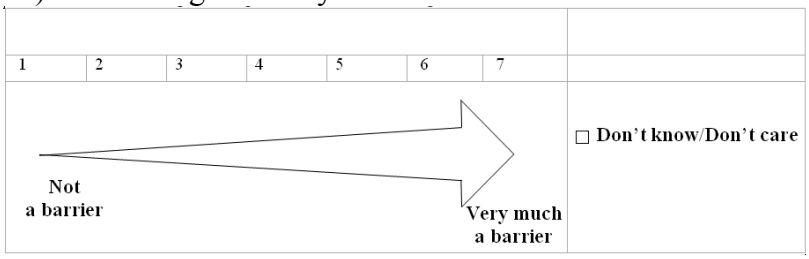
26) Not feeling prepared to address families' reactions to discussing their children's weight.



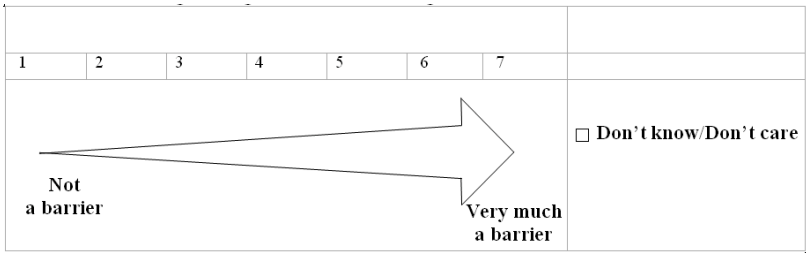
27) Overweight students not making addressing their weight a priority.



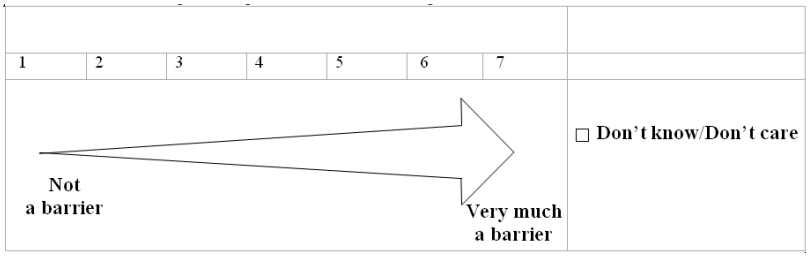
28) There being too many societal-level factors that contribute to children's weight.



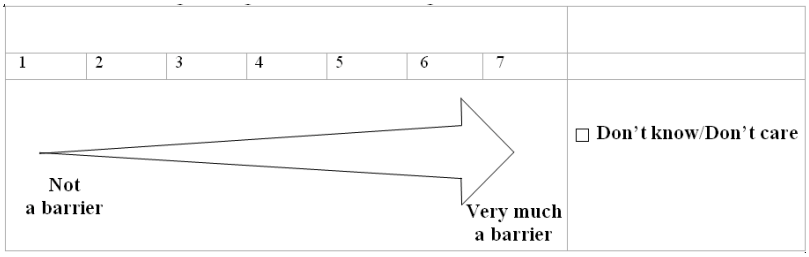
29) Not feeling competent to discuss weight-related health with overweight students' families.



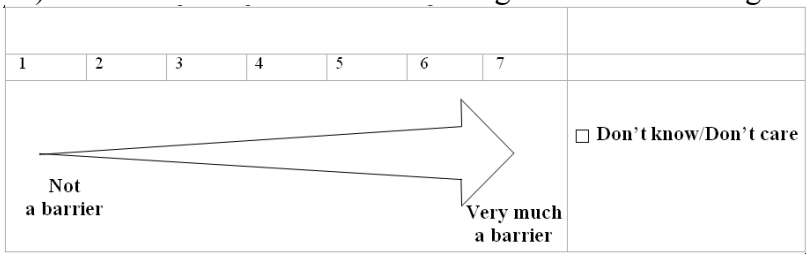
30) Families not following through on recommendations for how to address children's weight.



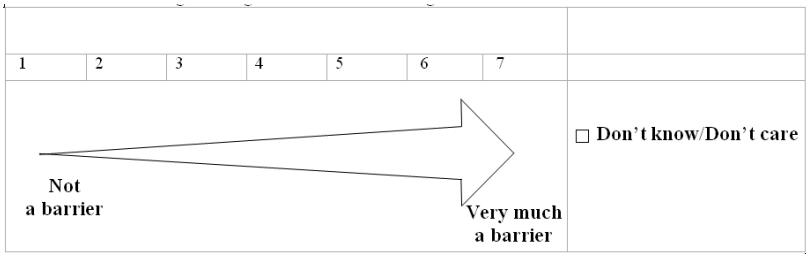
31) The school administration not supporting my efforts to address student's weight-related health.



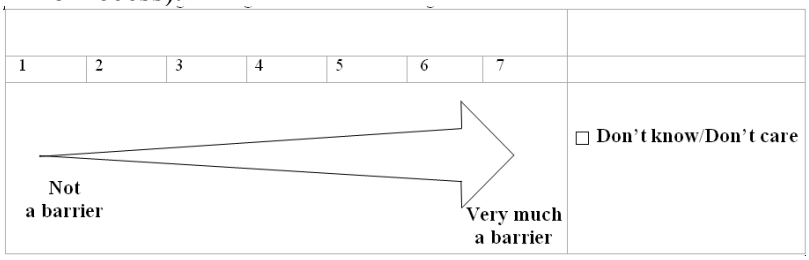
32) The home environment maintaining student's overweight status.



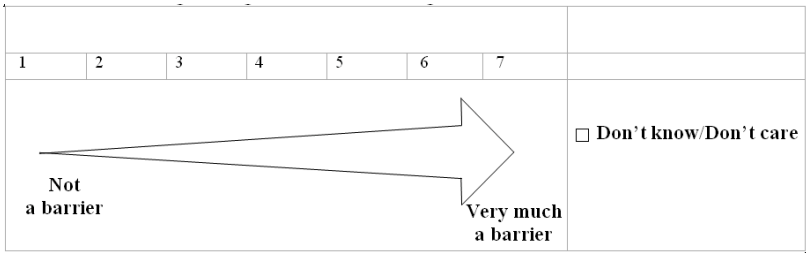
33) The school administration not allotting time for me to address student's weight-related health.



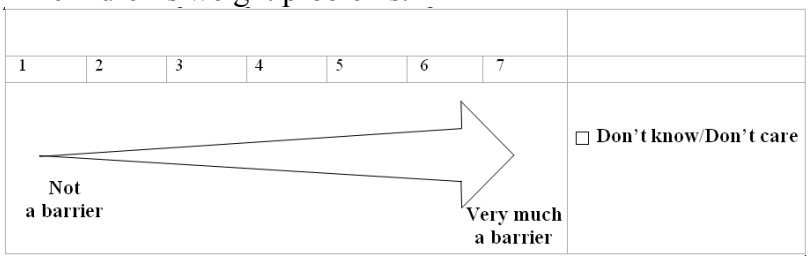
34) Students not offered enough opportunities for physical activity while in school (e.g., gym or recess).



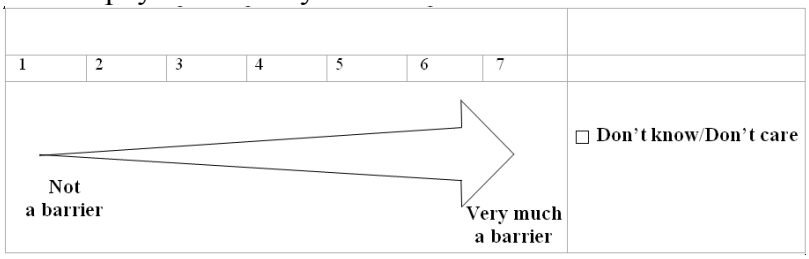
35) Worrying that addressing student's weight-related health would harm my relationship with teachers.



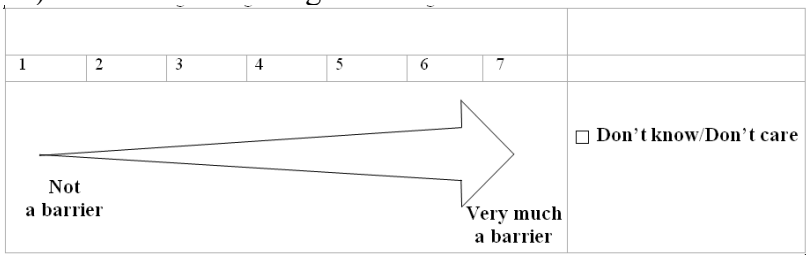
36) There being larger forces (e.g., accessibility of fast food restaurants) contributing to children's weight problems.



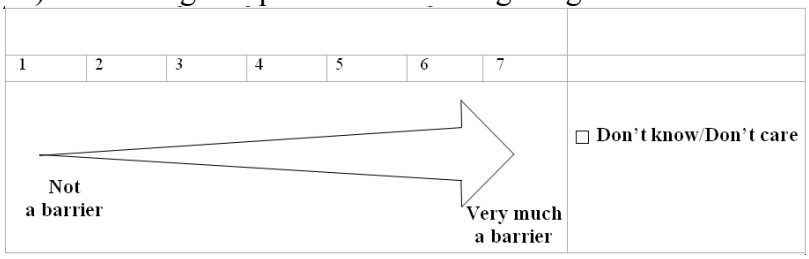
37) Not having enough information on pediatric weight-related health topics such as nutrition and physical activity.



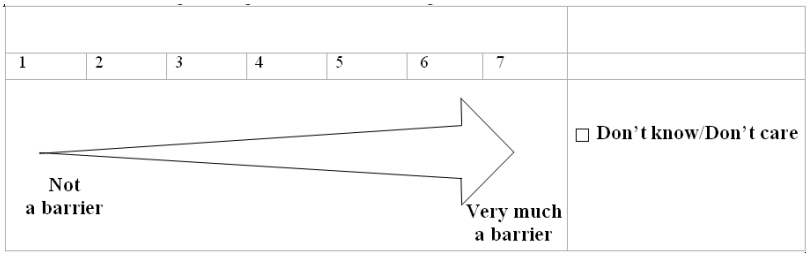
38) Families not wanting to talk with me about their children's weight.



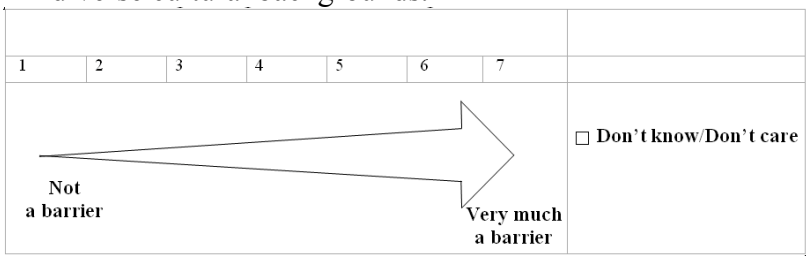
39) Not feeling competent in discussing weight-related health with overweight students.



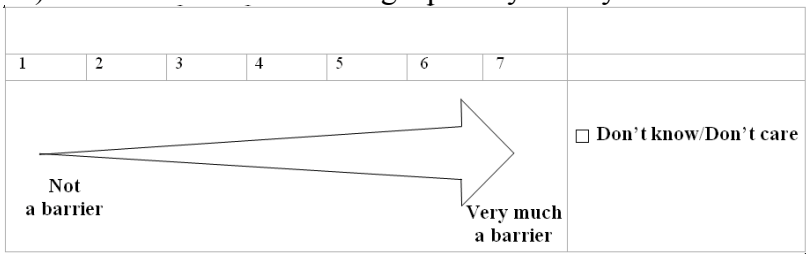
40) Difficulty addressing student's weight when their family members are overweight as well.



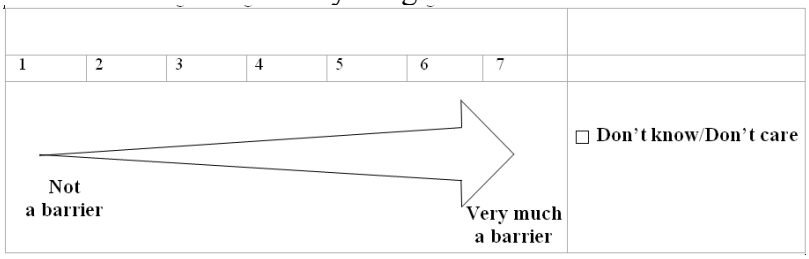
41) Being unsure of how to address weight-related health issues with students/families from diverse cultural backgrounds.



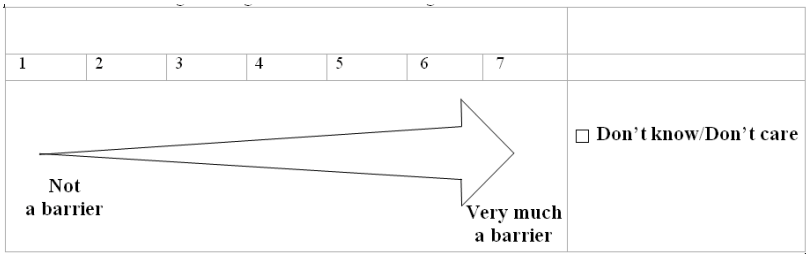
42) Health education not being a priority for my school's administration.



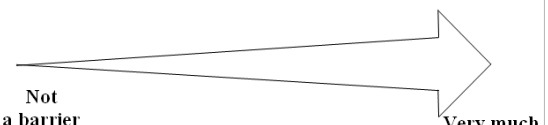
43) Not feeling comfortable discussing weight-related health issues with students and families because of my weight.



44) Teachers in my school(s) not supporting my efforts to address student's weight-related health.



45) Other school nurses not supporting my efforts to address student's weight-related health.

1 2 3 4 5 6 7	
	☐ Don't know/Don't care

Appendix B

Hypothesized Groupings of Items-on-Constructs

Knowledge/resources

Being unfamiliar with local pediatric weight programs to which I can refer students and families.

Not having resources on weight-related health, such as handouts, to share with students and families.

Not having enough information on pediatric weight-related health topics such as nutrition and physical activity.

Self-perceived competency

Not feeling prepared to address families' reactions to discussing their children's weight.

Not feeling prepared to address students' reactions to discussing their weight.

Not feeling competent to address psychological issues that overweight students may have.

Not feeling competent in discussing weight-related health with overweight students.

Not feeling competent to discuss weight-related health with overweight students' families.

Personal challenges

Not feeling comfortable discussing weight-related health issues with students and families because of my weight.

Struggling with the same weight-related issues that overweight students and their families struggle with.

Thinking that I should be a role model to students by maintaining a healthy weight.

School nurse's role

Addressing weight-related health with students or their families not being within my job responsibilities.

As a school nurse, not being obligated to discuss weight-related health with students and their families.

Not having time to address student's weight-related health.

Perceived support

My district nurse supervisor not supporting my efforts to address student's weight-related health.

School food service staff not supporting my efforts to address student's weight-related health.

The state government not supporting my efforts to address student's weight-related health.

Teachers in my school(s) not supporting my efforts to address student's weight-related health.

Students' families not supporting my efforts to address student's weight-related health.

Other school nurses not supporting my efforts to address student's weight-related health.

The school administration not supporting my efforts to address student's weight-related health.

Fear of reactions to addressing weight-related health

Worrying about families' reactions if I initiate discussion about their child's weight-related health.

Worrying that discussing weight-related health with students may contribute to the development of unhealthy attitudes about weight.

Worrying that addressing student's weight-related health would harm my relationship with teachers.

Worrying about the school administration's reactions to my efforts to address student's weight-related health.

Worrying about students' reactions to my initiating discussion of weight-related health.

Cultural differences between nurse and child/family

Being unfamiliar with cultural practices and attitudes towards weight different from my own.

Being unsure of how to address weight-related health issues with students/families from diverse cultural backgrounds.

Being unfamiliar with the traditional foods of different cultures.

Some students'/families' cultural groups having higher rates of overweight.

Family characteristics

Families not perceiving their children's weight to be a problem.

Families with limited resources (e.g., money and time) not being able to follow through with weight-related recommendations.

Families not following through on recommendations for how to address children's weight.

Families not wanting to talk with me about their children's weight.

The home environment maintaining student's overweight status.

Overweight students not making addressing their weight a priority.

Difficulty addressing student's weight when their family members are overweight as well

Institutional barriers

Food available to students in school not healthy.

Due to policies such as No Child Left Behind, not having enough resources to address student's weight-related health.

Health education not being a priority for my school's administration.

Students not offered enough opportunities for physical activity while in school (e.g., gym or recess).

The school administration not allotting time for me to address student's weight-related health.

Societal/Norm barriers

Not having control over important contributors to pediatric overweight, such as large portion sizes in restaurants and advertisements for unhealthy foods.

There being too many societal-level factors contributing to children's weight.

There being larger forces (e.g., accessibility of fast food restaurants) contributing to children's weight problems.

Appendix C

Responding to the Crisis Session Outline

Session	*Topic*
1	Role of school nurses to addressing pediatric weight-related health
2	Epidemiology and consequences of pediatric obesity
3	Assessment of pediatric obesity
4	Nutrition principles
5	Physical activity principles
6	Cultural issues related to pediatric obesity
7	Introduction to motivational interviewing and “asking” techniques
8	Motivational interviewing “listening” techniques
9	Motivational interviewing “providing information” techniques
10	Motivational interviewing techniques: How and when to apply them